It was found that the second form of experiment gave the most uniform results; the method by cooling being less accurate, owing to currents of air in the room, &c.

The results are embodied in the following Table:—

(Rate of Heating from 25° to 50°)

TABLE I.

Pressure.	Temperature.	Seconds occupied in rising each 5°.	Total number of seconds occupied.
760 millims.	25°	0	0
	25 to 30	15	15
	30 to 35	18	33
	35 to 40	22	55
	40 to 45	27	82
	45 to 50	39	121
1 millim.	25°	0	0
	25 to 30	20	20
	30 to 35	23	43
	35 to 40	25	68
	40 to 45	34	102
	45 to 50	48	150
620 M.[1]	25°	0	0
	25 to 30	20	20
	30 to 35	23	43
	35 to 40	29	72
	40 to 45	37	109
	45 to 50	53	162
117 M.	25°	0	0
	25 to 30	23	23
	30 to 35	23	46
	35 to 40	32	78
	40 to 45	44	122
	45 to 50	61	183
59 M.	25°	0	0
	25 to 30	25	25
	30 to 35	30	55
	35 to 40	36	91
	40 to 45	45	136
	45 to 50	67	203
23 M.	25°	0	0
	25 to 30	28	28
	30 to 35	33	61
	35 to 40	41	102
	40 to 45	55	157
	45 to 50	70	227
12 M.	25°	0	0
	25 to 30	30	30
	30 to 35	37	67
	35 to 40	41	108
	40 to 45	58	166
	45 to 50	86	252
5 M.	25°	0	0
	25 to 30	38	38
	30 to 35	43	81
	35 to 40	54	135
	40 to 45	71	206
	45 to 50	116	322
2 M.	25°	0	0
	25 to 30	41	41
	30 to 35	51	92
	35 to 40	65	157
	40 to 45	90	247
	45 to 50	165	412

There are two ways in which heat can get from the glass globe to the thermometer—(1) By radiation across the intervening space; (2) by communicating an increase of motion to the molecules of the gas, which carry it to the thermometer. It is quite conceivable that a considerable part, especially in the case of heat of low refrangibility, may be transferred by "carriage," as I will call it to distinguish it from convection which is different, and yet that we should not perceive much diminution of transference, and consequently much diminution of rate of rise with increased exhaustion, so long as we work with ordinary exhaustions up to 1 millim. or so. For if, on the one hand, there are fewer molecules impinging on the warm body (which is adverse to the carriage of heat), yet on the other the mean length of path between collisions is increased, so that the augmented motion is carried further. The number of steps by which the temperature passes from the warmer to the cooler body is diminished, and accordingly the value of each step is increased. Hence the increase in the difference of velocity before and after impact may make up for the diminution in the number of molecules impinging. It is therefore conceivable that it may not be till such high exhaustions are reached that the mean length of path between collisions becomes comparable with the diameter of the case, that further exhaustion produces a notable fall in the rate at which heat is conveyed from the case to the thermometer.

The above experiments show that there *is* a notable fall, a reduction of pressure from 5 M. to 2 M. producing twice as much fall in the rate as is obtained by the whole exhaustion from 760 millims. to 1 millim. We may legitimately infer that each additional diminution of a millionth would produce a still greater retardation of cooling, so that in such vacua as exist in planetary space the loss of heat—which in that case would only take place by radiation—would be exceedingly slow.

SCIENTIFIC SERIALS

Journal de Physique, December, 1880.—Note on magic mirrors, by M. Bertin.—On some applications of articulated systems, by M. Robin.—Experiments on the discharge in rarefied gases, by M. Righi.—Notice on the life and works of M. Almeida.

Archives des Sciences Physiques et Naturelles, November 15.—Meteorological *résumé* of the year 1879 for Geneva and the Great St. Bernard, by M. Plantamour.—Disinfection of vehicles, plants, collections of natural history, and various objects with anhydrous sulphurous acid, by Dr. Fatio—Observations on a memoir of M. Schönn, by M. Soret.—On the phenomenon of hydration in peptonisation of albuminoid substances, by Dr. Danilewsky.—Notes on the winds of mountains, by M. Pittier.—Case of diplopia, by Prof. Wartmann, &c.

Reale Istituto Lombardo di Scienze e Lettere. **Rendiconti.** vol. xiii. fasc. xviii., November, 1880.—This number contains lists of prizes awarded and offered.

Atti della R. Accademia dei Lincei, vol. v. fasc. 1 (December 5, 1880).—New studies on the nature of malaria, by SS. Cuboni and Marchiafava.—Graphic determination of the elastic force relative to plane elements passing through a point, by S. Modigliano.—On the geological nature of strata met with in the tubular foundations of the new iron bridge built on the Tiber at Ripatta, and on the *Unio sinuatus*, Lamk., there found, by S. Meli.—On the structure of the envelope of the ova of some fishes, by S. Lepori.—On the preservation of man in countries of malaria, by S. Tommasi-Crudeli.—On bilinear ternary forms, by S. Battaglini.—On the projected stations for systematic physical observations in polar regions, by S. Cora.—On a cebocephalic caprine monster, by S. de Sanctis.—On the recent restoration of the scholastic and tomistic philosophy, by S. Ferri.

SOCIETIES AND ACADEMIES

LONDON

Photographic Society, December 14, 1880.—J. Glaisher, F.R.S., president, in the chair.—Papers were read by Prof. T. E. Thorpe, F.R.S., on a simple and expeditious method of preparing pyrogallol for dry plate development. The method proposed is to put dry gallic acid and glycerine into a flask, which is then heated to 200° on a sand tray, as long as bubbles of carbon dioxide are seen to be formed in the liquid. The gallic acid soon dissolves and is entirely converted into the theoretical quantity of pyrogallol, viz., 80 per cent.—By Capt. Abney, R.E., F.R.S., iodide and ammonia in gelatine emulsions. It was stated that iodides in gelatine bromide emulsion kept the silver salts from being deposited upon the shadows, as also that there is freedom from decomposition of the film, and tendency to red fog, and more light can be used in preparing and developing the plates.—And also by Capt. Abney on a photographic sunshine recorder. This consisted of a semi-cylindrical box with a flat lid, in the centre of which is a small hole; round the inside of the cylinder strips of sensitive paper are

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[1] M = millionth of an atmosphere.

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fixed; the instrument is then so placed that the sun, the hole, and the centre line of the paper are in the same plane, so that as the sun moves its track will be recorded on the paper.

Victoria (Philosophical) Institute, January 3.—A paper on the early destinies of man was read by Mr. J. E. Howard, F.R.S., F.L.S., &c., in which he considered them in relation to science, to philosophy, and also to religion, and gave an analysis of the various known traditions in regard to the early history of man in all ages and in all countries.

MANCHESTER

Literary and Philosophical Society, December 14, 1880.—E. W. Binney, F.R.S., F.G.S., president, in the chair.—Boulder stones as grave stones. The president, when visiting Ashton-under-Lyne the other day, observed in the churchyard on the Manchester Road a greenstone boulder used as a tombstone over the grave of a son of an alderman of that borough. This is the first instance where he had seen a boulder stone used for such a purpose, and it is one where they may not only be preserved, but exhibited to the public.—The land subsidence at Northwich, by Thomas Ward.—Some endeavours to ascertain the nature of the insoluble form of soda existing in the residue left on causticising sodium carbonate solutions with lime (Part ii.), by Watson Smith, F.C.S., Assistant Lecturer on Chemistry in the Owens College, and W. T. Liddle. Communicated by Prof. C. Schorlemmer, F.R.S.

PARIS

Academy of Sciences, December 27, 1880.—M. Edm. Becquerel in the chair.—M. Faye presented the *Annuaire du Bureau des Longitudes* for 1881, and noted the improvements.—On the series of Fourier and other analytical representations of functions of a real variable, by M. Hermite.—On the velocity of propagation of light, by M. Cornu. He controverts M. Gouy's ideas.—On the chlorhydrates of metallic chlorides, and on the reduction of chlorides by hydrogen, by M. Berthelot. These chlorhydrates play an important part in chemical mechanics, by reason of their considerable heat of formation and their state of dissociation.—On an oxygenated base derived from aldol, by M. Wurtz.—Effects of tearing out the intracranial part of the glossopharyngeal nerve, by M. Vulpian. This action does not (in the cat) appreciably affect the influence of nerves which act as direct vaso-dilators on the mucous membrane of the buccal cavity, except as regards the effects of excitation of the nerve itself on the posterior region of the dorsal face of the tongue.—Observations on some animals of Madagascar, by M. Milne-Edwards. This relates to an important collection of mammalia and birds by M Humblot, sent to the Museum of Natural History They show the modifications of species well. M. Humblot has sent to the menagerie two living Aye-Ayes, two Makis, &c. (offering many points of interest).—Order of production of the first vessels in the ear of *Lolium* (first part), by M. Trécul.—M. Sella was elected Correspondent in Mineralogy in room of the late Prof. Miller, and Mr. Warren De La Rue in Astronomy in room of the late Mr. MacLear.—Observations on phylloxera, by M. Lichtenstein. He indicates ten or eleven animal parasites of phylloxera, but does not regard any of these hopefully as a means of stopping the disease. He is studying the effect of inoculation with cryptogams; the results are not yet decisive.—Determination of the time-of rotation of Jupiter, by M. Cruls. From observations of the spot at Rio Observatory during 1083 rotations he obtains the number 9h. 55m. 36s. in mean solar time. Mr. Pratt, at Brighton, got the number 9h. 55s. 33·91, from 321 rotations. Thus the time of Jupiter's rotation seems to be known to within a second.—On Hartwig's comet (*d* 1880), by MM. Schulhof and Bossert. They consider the period 62$\frac{2}{3}$ years must be rigorously excluded.—Solar observations at the Royal Observatory of the Roman College during the third quarter of 1880, by P. Tacchini. There was increased activity. The number of spots was double that in the preceding quarter, and there was hardly a day without them. The number of faculæ in September was extraordinary. In the case of the protuberances (also more frequent) there was a maximum in each hemisphere between 50° and 60° and another between 20° and 40°.—Observations on Swift's comet (*e* 1880) at the Royal Observatory of the Roman College, by P. Tacchini.—On the contact of conics and surfaces, by M. Moutard.—On a new method of producing intermittent luminous signals, by M. Crova. M. Leverrier and he used in 1870-71 a very similar arrangement to M. Mercadier's. They found that they must use oxygen under weak pressure and give the pipe a wide orifice; also that the key must be pressed and released very suddenly.—On a new electrodynamic theorem, by M. Cabanellas.—Regulator of pressure for vapours, by M. D'Arsonval. The triple problem here solved is (1) keeping constant, in a boiler, the pressure of a given vapour whatever the discharge; (2) using the combustible gas only in proportion to the vapour expended; (3) making the instrument quite automatic without danger of explosion. There is a membrane of caoutchouc between two metallic rings; its lower surface is in contact with the vapour, and on its upper rests a metallic disk with rod and lever like that of a safety valve. At the upper surface of the disk debouches a tube which brings the gas; there is another tube above through which the gas goes to the boiler.—On a new derivative of sulphide of nitrogen, by M. Demarcay.—On a platinous hypophosphite, by M. Engel. This is got by action of phosphuretted hydrogen on tetrachloride of platinum.—On borotungstates of sodium, by M. Klein.—On some facts relative to the transformation of chloral into metachloral, by M. Bryasson.—On the products of oxidation of cholalic acid.—On the excretion by urine of sulphur incompletely oxidised, in various pathological states of the liver, by MM. Lépine and Flavard.—On visual sensibility and its relations with luminous and chromatic sensibility, by M. Charpentier. What he calls visual sensibility corresponds to visual acuteness, but while the latter is expressed by the smallest angle under which one can recognise as distinct two luminous points; the former is expressed by the smallest quantity of light which renders those two points distinct. The order of increasing complexity is, luminous sensibility, chromatic sensibility, visual sensibility.—On the distribution of light in the solar spectrum (spectrum of Daltonians), by MM. Macé and Nicati. These observations appear to give certain proof of the existence of two distinct kinds of Daltonians; also to support the Young-Helmholtz theory of colours, and to contradict Hering's.—Reactions of the motor-zone of the brain in animals paralysed by curare, by MM. Couty and De Lacerda.—On passage of red corpuscles into the lymphatic circulation, by M. Laulaine. This is effected by obliteration of veins. The effect appears in about twelve hours, and the number of corpuscles increases to about the fortieth hour.—On the internal and external sheaths of hairs, by M. Renaut.—New researches on the organs of touch, by M. Ranvier. By observing the tactile corpuscles in infants and children he has come to a better appreciation of their structure.—On the sensitive nerve-termination in the skin of some insects, by M. Viallanes. Examining larvæ of *Musca* and *Eristalis*, he finds under the hypodermis an extremely rich plexus of ganglionic cells, connected on one hand with the chief nerve-centres, and on the other with sensitive terminal nerve-branches.—On the sensorial cylinders of the internal antenna of crustaceans, by M. Jourdain. While these have undoubtedly the characters of an organ of sense, they cannot (anatomically, and independently of all physiological experiment) be said to be affected with olfaction.—Marine mollusca living on the coasts of Campbell's Island, by M. Filhol.—Examination of the marine fauna of the upper sands of Pierrefitte near Etampes, by M. Meunier.—On the age of upheaval of the district of Bray, by M. Dollfus.—On the crystalline schists of Brazil and the red earths which cover them, by M. Gorceix.

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